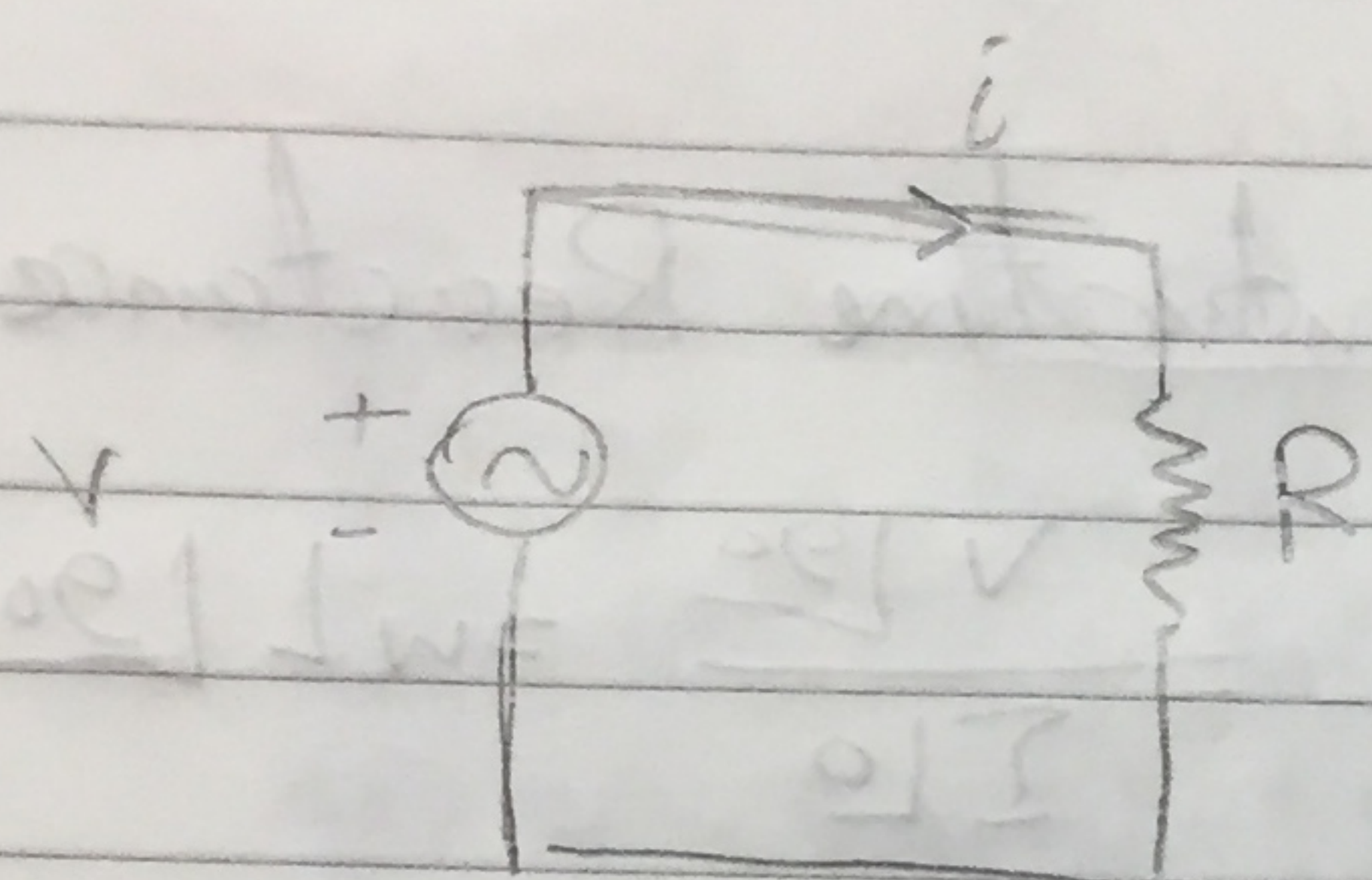


Subject.

Date.

Response of Basic elements to sinusoidal wave:

① R



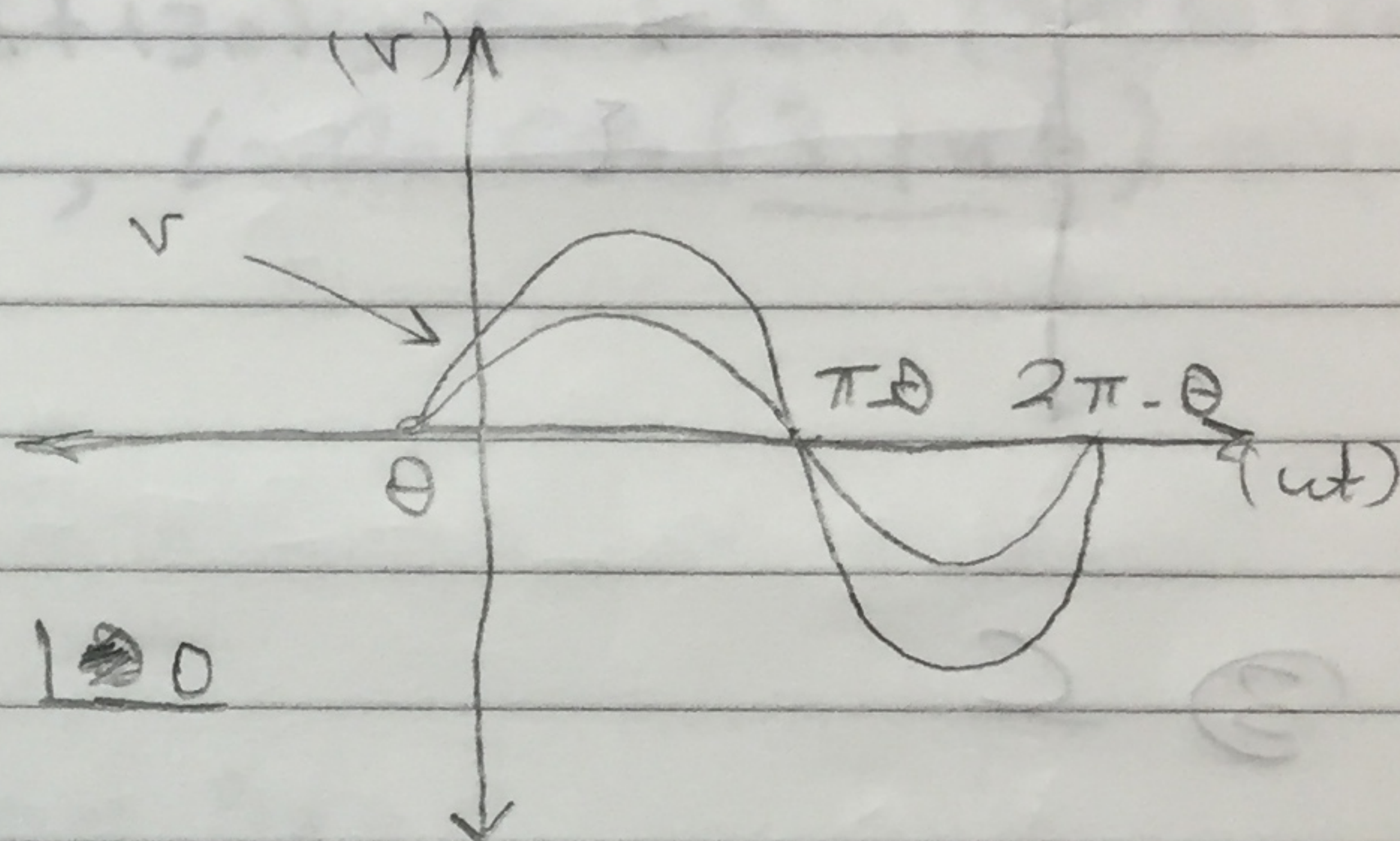
$$i = \frac{V}{R} = \frac{V_m}{R} \sin(\omega t + \theta)$$

$$= I_m \sin(\omega t + \theta)$$

$$V = V_m \sin(\omega t + \theta)$$

$$\vec{V} = \vec{V} \angle \theta$$

$$R = \frac{\vec{V}}{\vec{I}} = \frac{V \angle \theta}{I \angle \theta} = \frac{V}{I} \angle 0$$

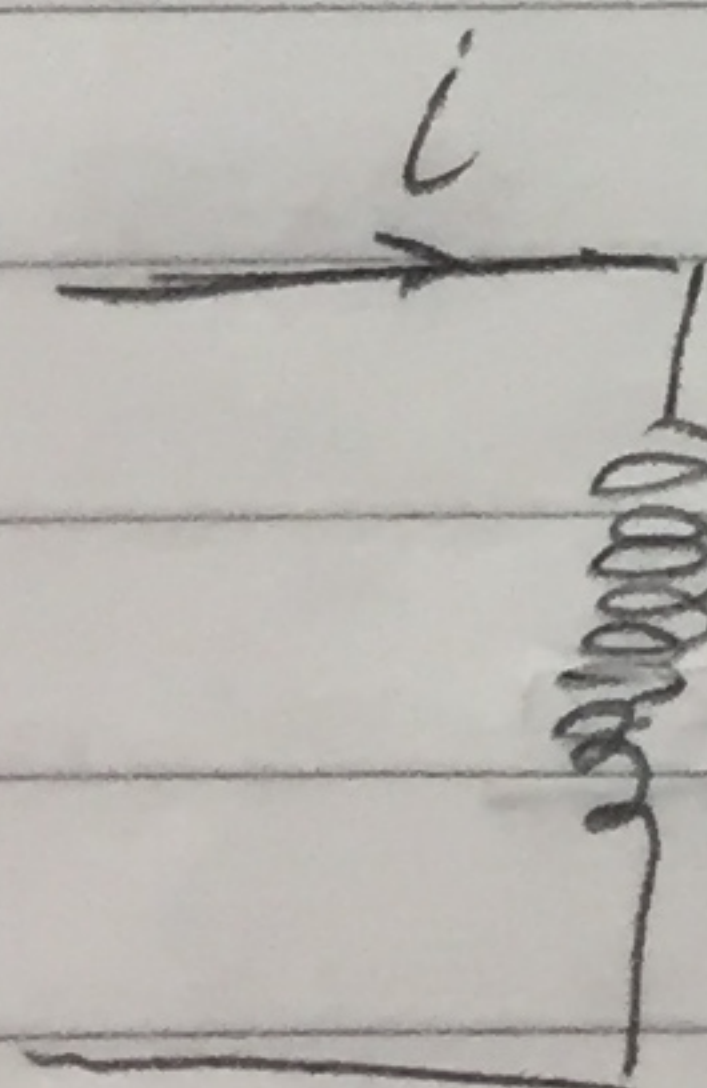


Power factor $\Delta \cos(\theta_v - \theta_i) = \cos \theta$

Pf = 1 unity PF

② L

$$V = L \frac{di}{dt} = L \frac{d}{dt} (I_m \sin \omega t)$$

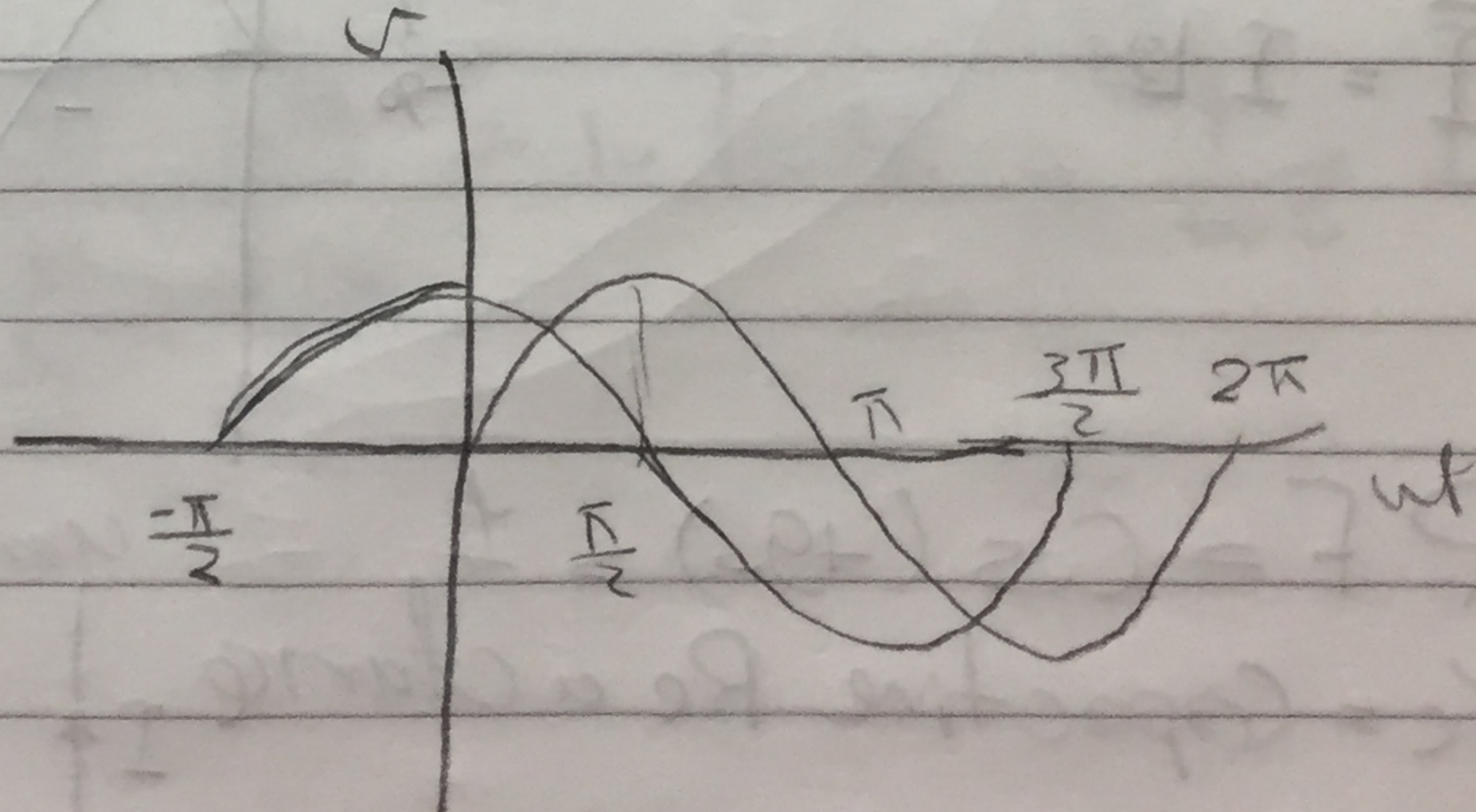


$$V = I_m \omega L \cos \omega t = I_m \omega L \sin(\omega t + 90^\circ)$$

$$i = I_m \sin(\omega t)$$

$$\vec{I} = I_m \angle 0$$

$$\omega L = I_m X_L$$



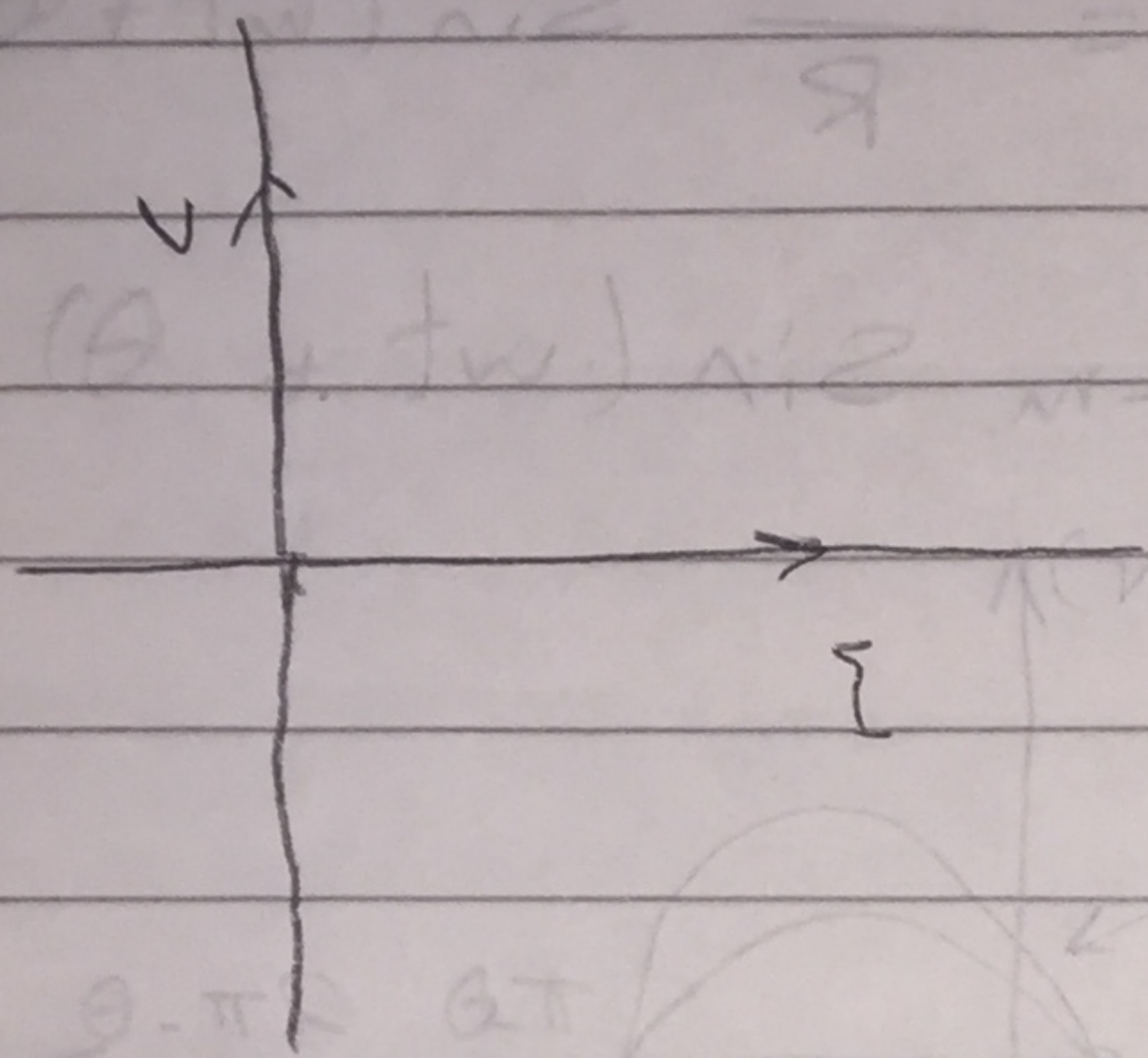
$$V = V_m \sin(\omega t + 90^\circ) \rightarrow \vec{V} = \frac{V_m}{\sqrt{2}} \angle 90^\circ$$

$$I_m X_L$$

أنظمة

$$v = V_m \sin(\omega t + 90^\circ) \rightarrow \vec{V} = \frac{V_m}{\sqrt{2}} \angle 90^\circ$$

$$PF = \cos(90^\circ) = 0 \text{ Lag}$$

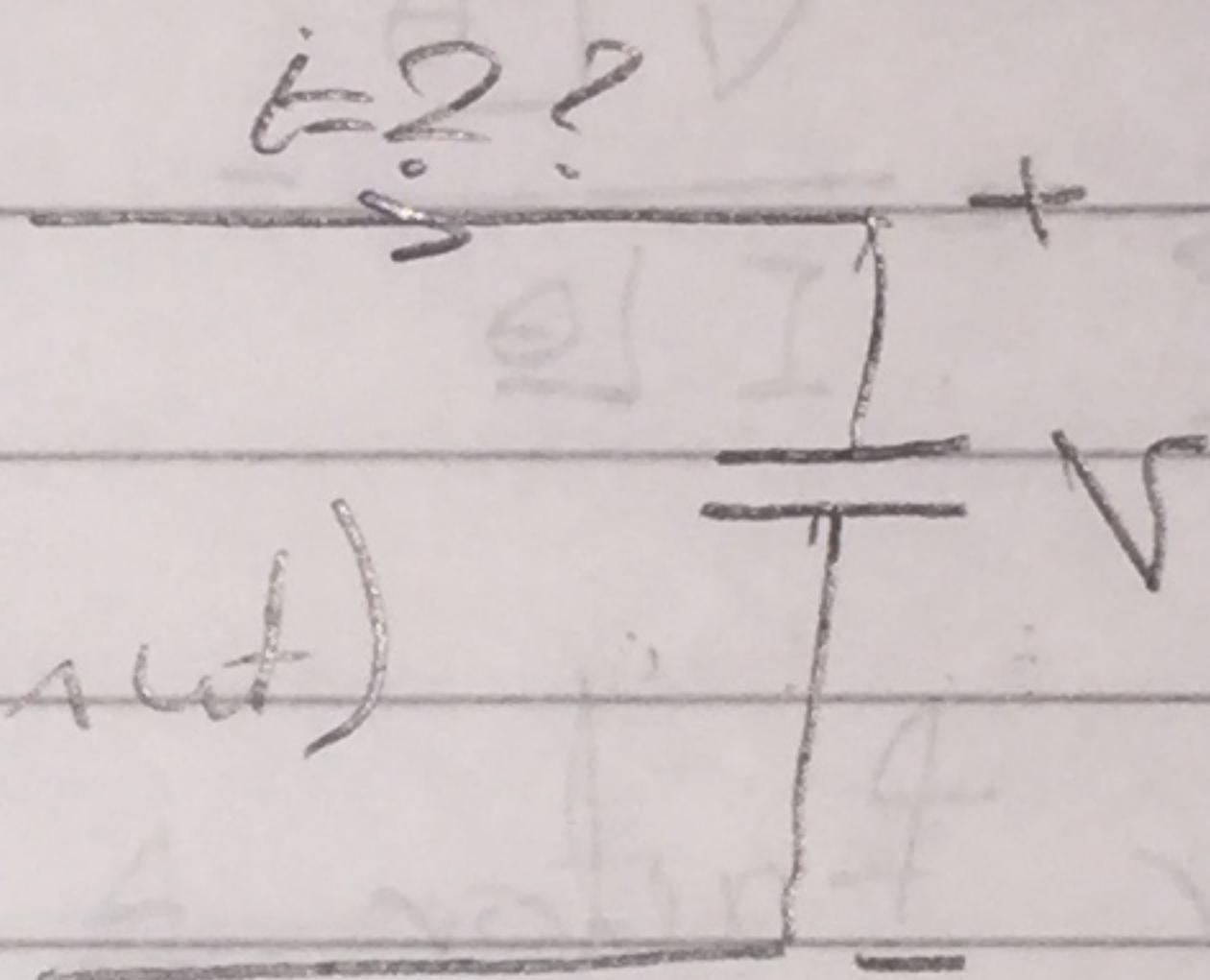


$X_L \triangleq$ Inductive Reactance

$$X_L = \frac{\vec{V}}{\vec{I}} = \frac{V \angle 90^\circ}{I \angle 0^\circ} = \omega L \angle 90^\circ$$

③ C

$$i = C \frac{dv}{dt} = C \frac{d}{dt} (V_m \sin \omega t)$$



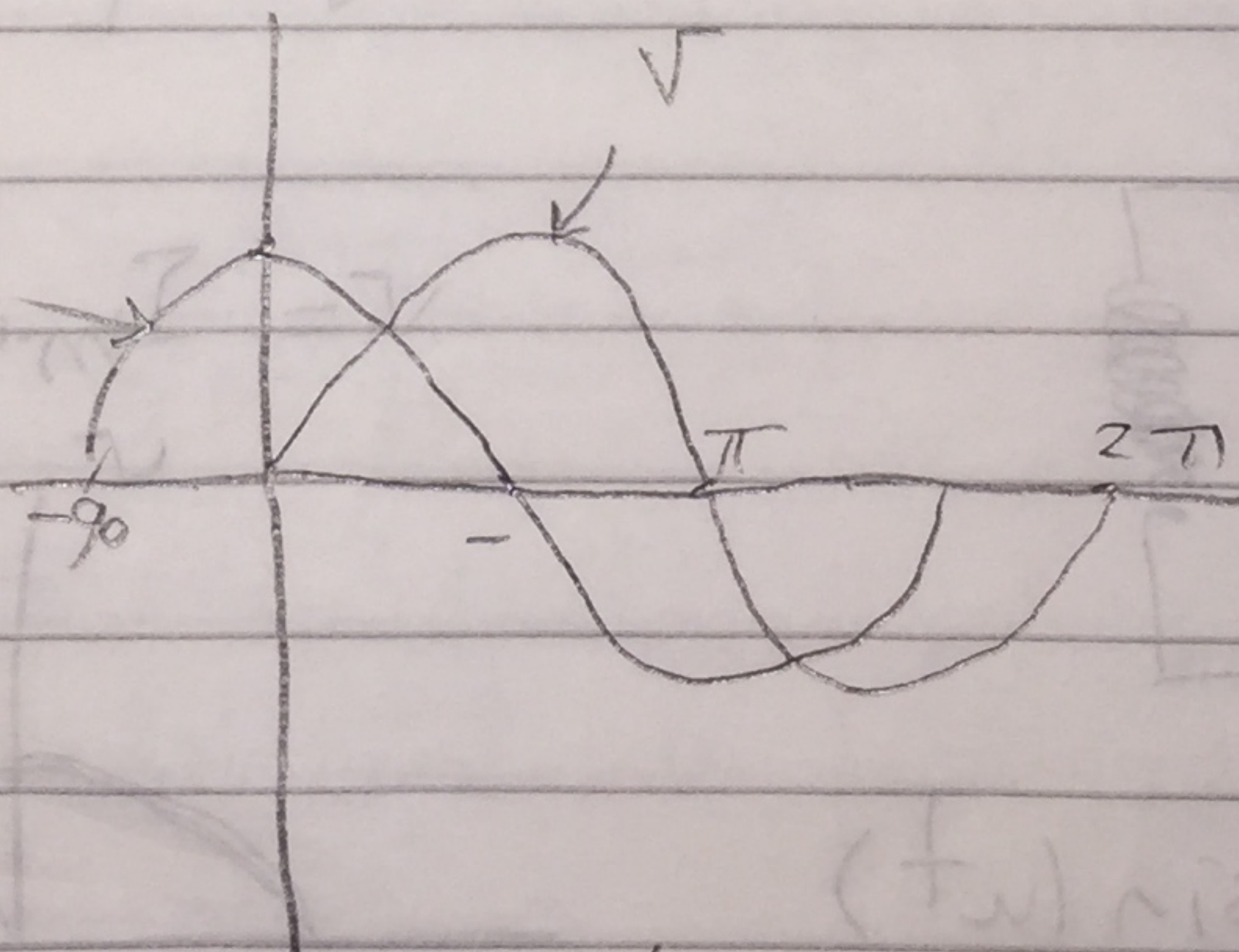
$$v = V_m \sin \omega t$$

$$= C V_m \omega \cos \omega t$$

$$= \omega C V_m \sin(\omega t + 90^\circ)$$

$$I_m \sin(\omega t + 90^\circ)$$

$$\vec{I} = I \angle 90^\circ$$



$$PF = \cos(+90^\circ) = 1$$

$X_C =$ Capacitive Reactance

$$X_C = \frac{\vec{V}}{\vec{I}} = \frac{V_m \angle 0^\circ}{\omega C V_m \angle 90^\circ} = \frac{1}{\omega C} \angle -90^\circ$$

unity PF

I

V

$$X_C = \frac{1}{\omega C} \angle -90^\circ = \frac{-j}{\omega C} = \frac{1}{j \omega C}$$

$$X_L = \omega L \angle 90^\circ = j \omega L$$

Respond of Basic elements to sinusoidal wave:

$$① v = 10 \sin(\omega t + 30^\circ), i = 25 \sin(\omega t + 30^\circ)$$

$$② v = 100 \sin(314t + 30^\circ), i = 10 \sin(314t + 60^\circ)$$

$$③ v = 100 \sin(314t + 30^\circ), i = 10 \sin(314t + 120^\circ)$$

$$④ v = 100 \sin(314t), i = 20 \cos(314t)$$

$$① R = \frac{V_m}{I_m} = 5 \Omega$$

② v lead i by 90°
 element is L

$$L = ?$$

$$X_L = \frac{V_m}{I_m} = \frac{100}{10} = 10$$

$$X_L = \frac{V_m \angle \theta_v}{I_m \angle \theta_i} = \frac{100 \angle 30^\circ}{10 \angle -60^\circ} = 10 \angle 90^\circ = j 10 = \omega L$$

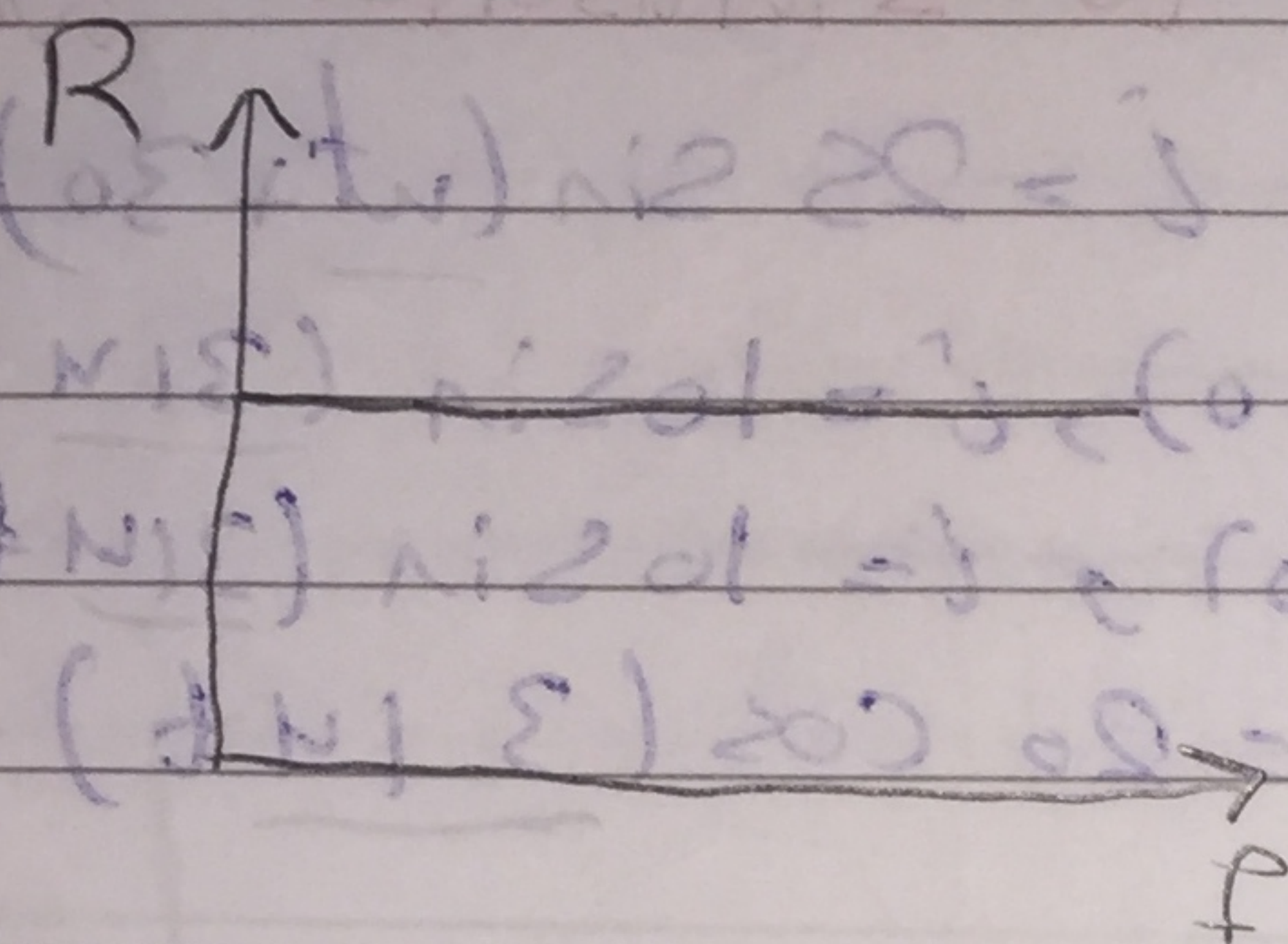
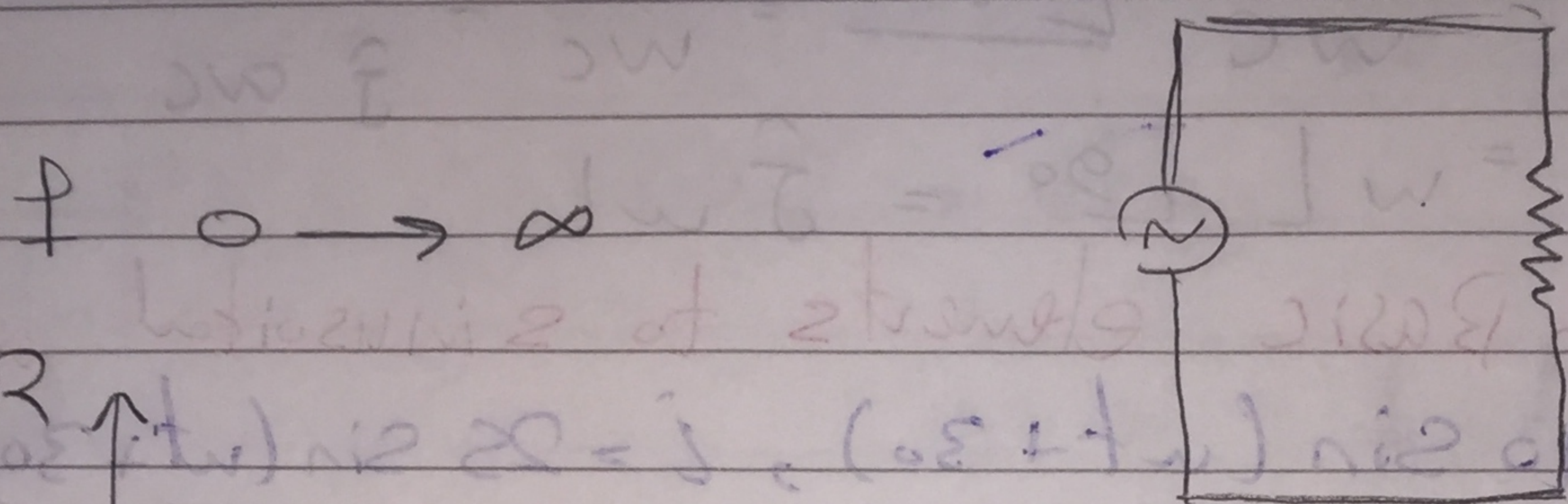
314

③ Since i lead v by 90°

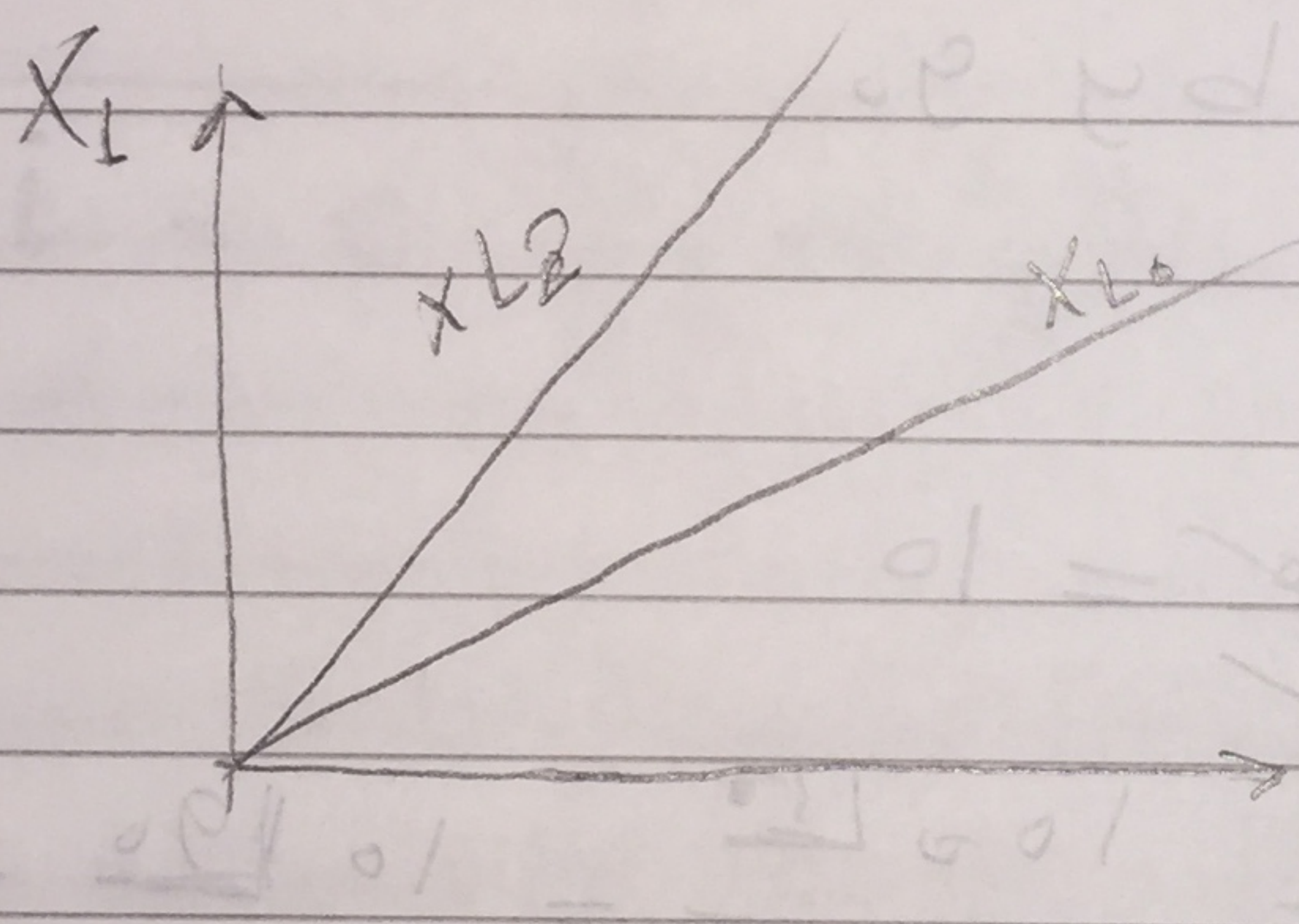
$$\therefore C$$

$$X_C = \frac{V}{I} = \frac{\frac{100}{\sqrt{2}} \angle 30^\circ}{\frac{10}{\sqrt{2}} \angle 120^\circ} = 10 \angle -90^\circ = \frac{1}{\omega C} \angle -90^\circ$$

Frequency Response of R, L, C



$$X_L = \omega L = 2\pi f L$$



$$X_C = \frac{1}{2\pi f C}$$

